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Wolff, Anne; Storbjerg Houmøller, Sabina; Schmidt, J. H.; Hougaard, Dan Dupont; Loquet, Gérard Sylvian Jean Marie; Hammershøi, Dorte; Gaihede, Michael

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# Health-Related Quality of Life in Experienced and First-time Hearing Aid Users Before and After Hearing-Aid Rehabilitation in a Cohort of Danish Adults

A Wolff<sup>1,2</sup>, S S Houmøller<sup>2,3,4</sup>, J H Schmidt<sup>2,3,4</sup>, D D Hougaard<sup>1,5</sup>, G Loquet<sup>1,5,6</sup>, D Hammershøj<sup>6</sup>, M Gaihede<sup>1,5</sup>

<sup>1</sup>Dept. of Otolaryngology, Head & Neck Surgery and Audiology, Aalborg University Hospital, Denmark <sup>2</sup>OPEN, Odense Patient data Explorative Network, Odense University Hospital, Odense, Denmark <sup>3</sup>Department of Otolaryngology, Head & Neck Surgery and Audiology Odense University Hospital, Odense, Denmark <sup>4</sup>Department of Clinical Research, University of Southern Denmark, Odense, Denmark <sup>5</sup>Department of Clinical Medicine, Aalborg University, Aalborg, Denmark <sup>6</sup>Department of Electronic Systems, Aalborg University, Denmark

## Introduction

Several studies have reported effect of hearing aid (HA) treatment on Health Related Quality of Life (HRQoL), but there are still disagreements about the results [1]. In earlier studies the study populations have predominately consisted of first-time HA users. Hence, little is known of the experienced users effects on HRQoL following HA renewal.

The aim of this study was to evaluate the change of HRQoL after two months of HA treatment in both first-time and experienced HA users. Audiometric threshold measurements and questionnaire data were used to evaluate the effects of treatment on HRQoL.

### The 15-Instrument (15D)

HRQoL was measured with the 15D-instrument (15D). 15D is a generic, standardized, self-administered questionnaire designed to measure HRQoL [2]. The questionnaire holds a question on each of the 15 dimensions: Mobility (move), Vision (see), Hearing (hear), Breathing (breath), Sleeping (sleep), Eating (eat), Speech (speech), Excretion (excret), Usual Activities (uact), Mental Function (mental), Discomfort and Symptoms (disco), Depression (depr), Distress (distr), Vitality (vital) and Sexual Activity (sex). Each dimension has five ordinal levels of answers. The patient chooses the level that best describes her/his present health status (Table 1). The questionnaire is designed to provide a profile and a single index score. A set of national utility weights is used to generate the scores on a 0-1 scale, with 1 being the best.

#### QUESTION 3. HEARING (utility weights)

- 1 (1) I can hear normally, i.e. normal speech (with or without a hearing aid).
- 2 (0.7734) I hear normal speech with a little difficulty.
- 3 (0.5439) I hear normal speech with considerable difficulty; in conversation I need voices to be louder than normal.
- 4 (0.2969) I hear even loud voices poorly; I am almost deaf.
- 5 (0.1621) I am completely deaf.

Table 1. The hearing dimension of the 15D questionnaire (15D-3) with the 5 level answers. In parenthesis the Danish utility weights [3].

## Method

The results reported here are derived from a part of the national research project the “Better Hearing Rehabilitation” (BEAR), which was conducted in two audiological departments in Denmark: Department of Audiology, Odense University Hospital and Department of Audiology, Aalborg University Hospital. The project was a prospective observational study. Patients followed standard procedures of hearing assessment and HA fitting. Additionally, they had a follow-up visit scheduled two-month post HA fitting. In further addition, the 15D, IOI-HA [4] and a general health-related questionnaire, including two questions on motivation for HA treatment, was sent to the patients (Figure 1). Out of the 2447 patients invited to participate, 1961 accepted the invitation. 486 patients which withdrew their consent to participate, did not fully answer the 15D, were eligible for surgical rehabilitation of hearing loss (HL), did not have a serviceable HL or declined HA treatment and were excluded from the study. The study population of interest ended on 1562 patients (Figure 2).



Figure 1. Study timeline. Inclusion started in December 2016 and the last follow-up visit was in May 2018.

#### AIM

To evaluate the quality of life following hearing aid treatment in first-time and experienced hearing aid users

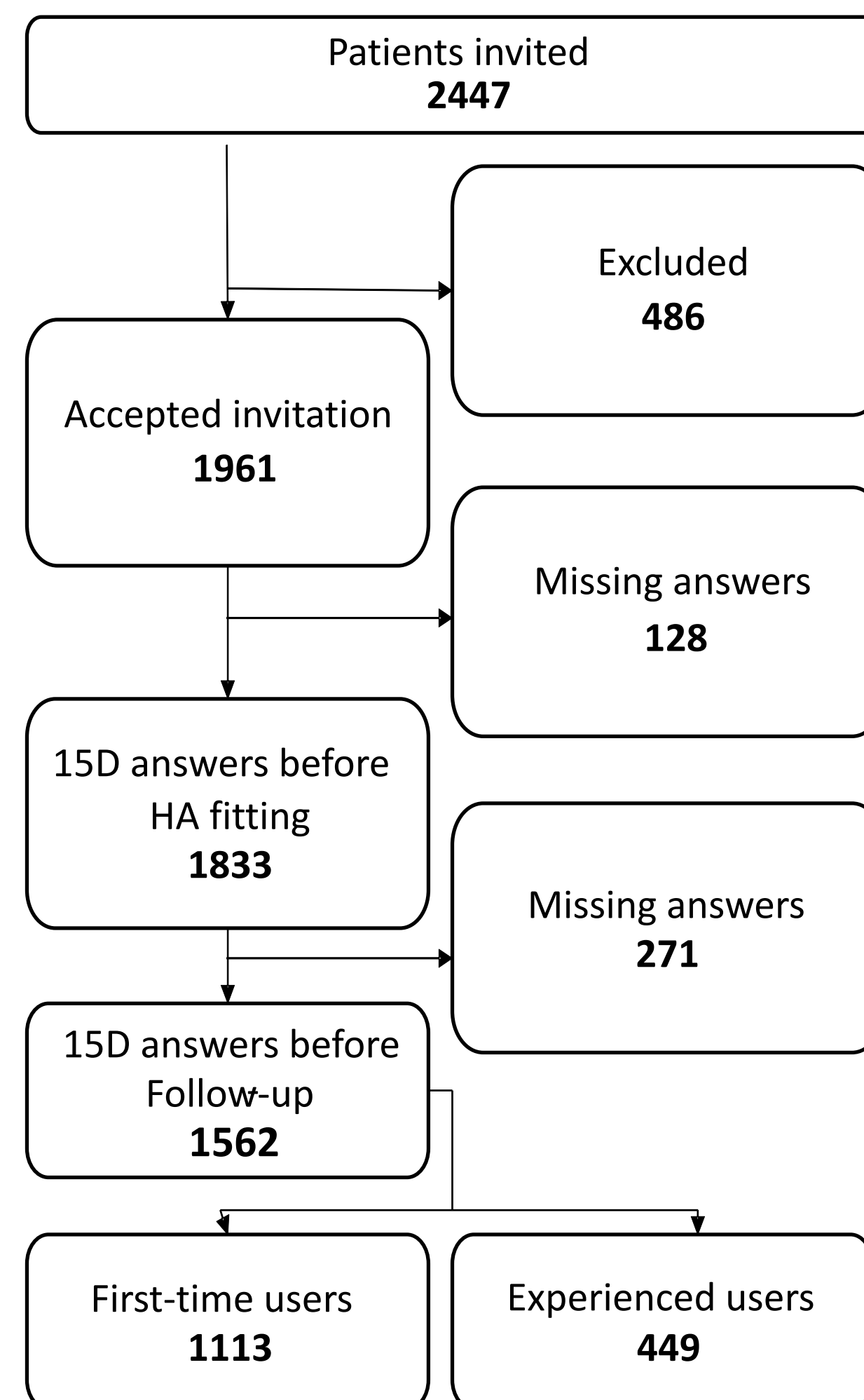


Figure 2. Trail profile.

	Total (n=1562)	First-time users (n=1113)	Experienced users (n=449)
Age, mean ± SD, years	66.5 ± 11.1	65.9 ± 10.9	67.7 ± 11.5
Range	19-94	21-94	19-89
Gender			
Male, percentage	58.3	57.1	61.0
Female, percentage	41.7	42.9	39.0
Experience with HA			
Unexperienced, percentage		71	-
Experienced users, percentage		-	29
Duration of experience, mean ± SD, years		-	9.6 ± 8.8
Better ear hearing level (PTA), mean ± SD, dB HL	35.4±12.9	32.1±10.9	43.6±14
Better ear speech discrimination scores, percentage, mean ± SD	92.4±12.0	93.9±10.99	88.5±13.6
Severity of hearing loss based on better ear PTA*			
Normal Hearing, ≤19 dB HL	8.8	11.3	2.7
Mild Hearing Loss, 20-34 dB HL	40.5	48.3	21.2
Moderate Hearing Loss, 35-49 dB HL	37.4	34.3	45.0
Moderate-Severe Hearing Loss, 50-64 dB HL	10.6	5.6	23.0
Severe Hearing Loss, 65-79 dB HL	2.2	0.4	6.9
Profound Hearing Loss, ≥80 dB HL	0.5	0.1	1.3
Hearing Aid characteristics			
Usage time, mean± SD, hours	8.9±5.0	8.3± 4.9	10.3± 10.3
Number of hearing aids			
Monaural, percentage	4.3	5.1	2.2
Binaural, percentage	95.7	94.9	97.8
Place of rehabilitation, percentage			
The North Denmark Region	38.4	43.0	27.0
The Region of Southern Denmark	61.6	57.0	73.0

\*Hearing Scale GBD [5]

Table 2. Background characteristics.



Figure 3. 15D profile and single 15D score. Scores in first-time\* and experienced\*\* users of HA at baseline and two-months follow-up.

## Results

At baseline, first-time users had a higher mean score of the hearing dimension of 15D (15D-3) than the experienced users. Two months after HA-rehabilitation a significant improvement in follow-up scores in both groups were observed (Figure 3). The first-time users ( $\Delta$ 15D-3: 0.72) improved more than the experienced users ( $\Delta$ 15D-3: 0.68) with significant difference (0.22,  $p=0.04$ ). When looking at overall improvement of HRQoL (single 15D score) only first-time users improved in score. When estimating multiple regression models, (Table 3, A.) the hearing model (with the change in 15D-3 as the outcome variable) was robust, but only explained 3% of the variance. When adding self-reported hearing ability as an explanatory variable (Table 3, B.) the explanation of variance increased to 30%.

A.	Hearing model (15D-3)				Single 15D score model			
	Coef.	95% CI	p	R <sup>2</sup> =0.029	Coef.	95% CI	p	R <sup>2</sup> =0.0097
Explanatory variable								
Constant	-0.018	-0.10; 0.07	0.680		0.013	-0.01; 0.03	0.219	
Age, years	0.000	0.00; 0.00	0.711		0.000	0.00; 0.00	0.996	
Gender (male=0, female=1)	-0.015	-0.03; 0.01	0.148		-0.002	-0.01; 0.00	0.446	
HA experience (first-time=0, experienced=1)	-0.041	-0.07; -0.02	<b>0.001</b>		-0.008	-0.01; 0.00	0.009	
Hearing loss (normal=0)								
Mild	0.022	-0.01; 0.06	0.245		0.004	0.00; 0.01	0.339	
Moderate	0.034	-0.01; 0.07	0.092		0.005	0.00; 0.01	0.272	
Moderate-severe	0.046	0.00; 0.10	0.068		0.004	-0.01; 0.02	0.551	
Severe-profound	-0.030	-0.10; 0.04	0.417		0.014	0.00; 0.03	0.112	
HA usage time, hours	0.003	0.00; 0.01	<b>0.005</b>		0.000	0.00; 0.00	0.332	
Motivation_ability, 0-100	0.000	0.00; 0.00	0.256		0.000	0.00; 0.00	0.384	
Motivation_importance, 0-100	0.001	0.00; 0.00	<b>0.022</b>		0.000	0.00; 0.00	0.297	
B.	Hearing model (15D-3)				Single 15D score model			
	Coef.	95%CI	p	R <sup>2</sup> =0.294	Coef.	95%CI	p	R <sup>2</sup> =0.033
Explanatory variable								
Constant	0.556	0.47; 0.64	<b>&lt;0.001</b>		0.052	0.03; 0.08	<b>&lt;0.001</b>	
Age, years	0.001	0.00; 0.00	0.177		0.000	0.00; 0.00	0.218	
Gender (male=0, female=1)	0.006	-0.01; 0.02	0.530		0.000	-0.01; 0.00	0.854	
HA experience (first-time=0, experienced=1)	-0.023	-0.04; 0.00	<b>0.028</b>		-0.007	-0.01; 0.00	<b>0.026</b>	
Hearing loss (normal=0)								
Mild	0.002	-0.03; 0.03	0.896		0.003	-0.01; 0.01	0.511	
Moderate	-0.005	-0.04; 0.03	0.790		0.003	-0.01; 0.01	0.585	
Moderate-severe	-0.044	-0.09; 0.00	<b>0.047</b>		-0.003	-0.01; 0.01	0.665	
Severe-profound	-0.159	-0.22; -0.10	<b>&lt;0.001</b>		0.005	-0.01; 0.02	0.564	
HA usage time, hours	0.003	0.00; 0.00	<b>0.004</b>		0.000	0.00; 0.00	0.382	
Motivation_ability, 0-100	0.000	0.00; 0.00	0.214		0.000	0.00; 0.00	0.367	
Motivation_importance, 0-100	-0.001	0.00; 0.00	<b>0.006</b>		0.000	0.00; 0.00	0.749	
Self-reported hearing ability at baseline (15D-3 score, on a scale from 0-1)	-0.663	(0.72; -0.61)	<b>&lt;0.001</b>		-0.046	-0.06; -0.03	<b>&lt;0.001</b>	

Table 3. Multiple linear regression analysis for change in 15D-3 and single 15D score. A. Age, gender, severity, HA usage time and motivation as explanatory variables. B. Age, gender, severity, HA usage time, motivation and self-reported hearing ability (15D-3 score) at baseline as explanatory variables.

## Discussion

First-time and experienced users both improved in 15D-3 scores two months after HA fitting. Although, first-time users improved the most. An explanation for the smaller increase in score for the experienced users could be that, they have sustained some of the effect from previous HA fitting. Hence, having less room for improvement.

When studying the change in hearing related and general HRQoL as outcomes and incorporating factors such as age, gender etc. (Table 2), the statistic show that self-reported hearing ability (SRHA) was a better predictor of change, than HL measured by standard speech and tone audiometry or the other variables [6]. We speculate whether there is an association between SRHA and motivation for HA treatment which can subsequently be of importance for the change in HRQoL. Previous research have found that SRHA is a better predictor of help-seeking, HA uptake, HA use and satisfaction with HA, hence supporting our hypothesis [7].

## Conclusions

HA rehabilitation resulted in improved scores of hearing related HRQoL for both first-time and experienced users. The improvement of general HRQoL was marginal for both groups, although the change for first-time users did show strong statistically evidence of improvement but, did not reach the minimal importance change (15D: MIC=0.015). Based on this work we suggest that HA rehabilitation improve hearing related QoL for both first-time and experienced users and propose that SRHA is a good predictor for the change.

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